The Most Common Causes of Eye Pain at 2 Tertiary Ophthalmology and Neurology Clinics

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Abstract: BACKGROUND Eye pain is a common complaint, but no previous studies have determined the most common causes of this presenting symptom. Our objective was to determine the most common causes of eye pain in 2 ophthalmology and neurology departments at academic medical centers. METHODS This was a retrospective cross-sectional analysis and chart review at the departments of ophthalmology and neurology at the University Hospital Zurich (USZ), University of Zürich, Switzerland, and the University of Utah (UU), USA. Data were analyzed from January 2012 to December 2013. We included patients aged 18 years or older presenting with eye pain as a major complaint. RESULTS Two thousand six hundred three patient charts met inclusion criteria; 742 were included from USZ and 1,861 were included from UU. Of these, 2,407 had been seen in an ophthalmology clinic and 196 had been seen in a neurology clinic. Inflammatory eye disease (conjunctivitis, blepharitis, keratitis, uveitis, dry eye, chalazion, and scleritis) was the underlying cause of eye pain in 1,801 (69.1%) of all patients analyzed. Although only 71 (3%) of 2,407 patients had migraine diagnosed in an ophthalmology clinic as the cause of eye pain, migraine was the predominant cause of eye pain in the neurology clinics (100/196; 51%). Other causes of eye pain in the neurology clinics included optic neuritis (44 patients), trigeminal neuralgia, and other cranial nerve disorders (8 patients). CONCLUSIONS Eye pain may be associated with a number of different causes, some benign and others sight- or life-threatening. Because patients with eye pain may present to either a neurology or an ophthalmology clinic and because the causes of eye pain may be primarily ophthalmic or neurologic, the diagnosis and management of these patients often requires collaboration and consultation between the 2 specialties.

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Background: Eye pain is a common complaint, but no previous studies have determined the most common causes of this presenting symptom. Our objective was to determine the most common causes of eye pain in 2 ophthalmology and neurology departments at academic medical centers.
Methods: This was a retrospective cross-sectional analysis and chart review at the departments of ophthalmology and neurology at the University Hospital Zurich (USZ), University of Zürich, Switzerland, and the University of Utah (UU), USA. Data were analyzed from January 2012 to December 2013. We included patients aged 18 years or older presenting with eye pain as a major complaint.
Results: Two thousand six hundred three patient charts met inclusion criteria; 742 were included from USZ and 1,861 were included from UU. Of these, 2,407 had been seen in an ophthalmology clinic and 196 had been seen in a neurology clinic. Inflammatory eye disease (conjunctivitis, blepharitis, keratitis, uveitis, dry eye, chalazion, and scleritis) was the underlying cause of eye pain in 1,801 (69.1%) of all patients analyzed. Although only 71 (3%) of 2,407 patients had migraine diagnosed in an ophthalmology clinic as the cause of eye pain, migraine was the predominant cause of eye pain in the neurology clinics (100/196; 51%). Other causes of eye pain in the neurology clinics included optic neuritis (44 patients), trigeminal neuralgia, and other cranial nerve disorders (8 patients).
Conclusions: Eye pain may be associated with a number of different causes, some benign and others sight- or life-threatening. Because patients with eye pain may present to either a neurology or an ophthalmology clinic and because the causes of eye pain may be primarily ophthalmic or neurologic, the diagnosis and management of these patients often requires collaboration and consultation between the 2 specialties.

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Eye pain is a common complaint in ophthalmology and also can be a complaint in neurology. No previous studies have determined the most common causes of this presenting symptom. Our objective was to determine the most common causes of eye pain in 2 tertiary ophthalmology and neurology departments. We then wished to know how the most common causes of eye pain differed at the 2 institutions and how these causes differed between departments of ophthalmology and neurology. We also wanted to know if the laterality or character of the pain was associated with particular causes of eye pain.

METHODS

Study Design and Objective

A retrospective cross-sectional analysis was performed at the University of Utah (UU), USA and at the University

Hospital Zurich (USZ), Switzerland for all patients who presented to these tertiary ophthalmology and neurology departments with a primary complaint of eye pain in the history of present illness. The primary outcome was the diagnosed cause of eye pain. Secondary outcomes included laterality of the pain, characteristics of the pain (e.g., burning pain, stabbing pain, pain with eye movement), patient demographics, and whether the patient presented to a neurology or an ophthalmology clinic for evaluation.

Identification and Eligibility of Patients

Institutional review board approval was obtained for both institutions. Because this investigation was a retrospective chart review and because no protected health information was collected, informed consent was waived. The electronic medical records (EMRs) were reviewed for all patients aged 18 years and older with a major complaint of eye pain seen at UU or USZ within the departments of ophthalmology and neurology from January 2012 through December 2013. Major complaint of eye pain was defined as either the chief complaint or a primary complaint in the history of present illness. Eye pain was defined as pain localized in, around, or behind the eye. If available, symptoms of burning, stabbing, aching pain, and pain with eye movement as well as patient age, gender, and laterality of the pain (right, left, or both eyes) were recorded. Whether the patient primarily sought care in an ophthalmology or neurology department and the final diagnosis thought to be the cause of the patient's pain also was recorded.

Data Collection

At USZ, records of daily neurology and ophthalmology clinic schedules from 2012 to 2013 were reviewed and screened for patients who presented with symptoms of eye pain, including soreness, ache, or irritation of the eye(s). From the EMR, it was determined if the patient met inclusion criteria and, if so, outcome data were extracted. The EMRs for all UU ophthalmology clinics were only available for review from mid-year 2013 forward, and for UU neurology from mid-year 2012 forward. The UU first screened all patient EMR charts for key terms of "pain," "ache," "sore," or "irritation" within both departments. After reviewing more than 300 charts to determine key phrases used by clinicians to describe eye pain, the patient records containing the initial screening terms underwent a second Microsoft Excel macros search term algorithm created by one of the authors (C.C.) that highlighted the following terms: "pain in left eye" OR "pain in right eye" OR "pain left eye" OR "pain right eye" OR "pain in the left eye" OR "pain in the right eye" OR "pain with eye movement" OR "eye pain" OR "eye irritation" OR "pain in both eyes" OR "burning sensation" OR "retro-orbital" OR "retroorbital" OR "eyeball pain" OR "eye ball pain" OR "eyeball pain" OR "pain right ocular" OR "pain left ocular." Patient charts containing at least one highlighted search term were reviewed for inclusion criteria. We performed a second query in the UU data storage warehouse to access all patient charts with chief complaints of eye pain, eye pain no injury, eye itching/irritation, eye irritation, eye burn, and burning eyes. Each patient chart underwent review for inclusion criteria. Data were collected using Excel 2013 (Microsoft, Redmond, WA).

Statistical Analysis

Chi-square (χ^2) tests were used (statistical significance set at $P < 0.05$) to compare primary outcomes between institutions, departments, ages, gender, laterality, and pain characteristics. Patients who did not have a descriptive pain characteristic other than "eye pain" were excluded from the pain characteristics analysis. Age was categorized into 4 groups for statistical analyses (18–34, 35–54, 55–64, and ≥65 years). All analyses were conducted using STATA statistical software, v 14 (Stata Corp LP, College Station, TX).

RESULTS

A total of 80,486 charts were reviewed; 2,603 of these met inclusion criteria and were further reviewed for demographics and descriptive pain characteristics (Fig. 1). From the UU, 1,709 records from the Department of Ophthalmology and 152 records from the Department of Neurology were included. From the USZ, 698 records from the Department of Ophthalmology and 44 records from the Department of Neurology were included. There were 269 diagnoses of eye pain categorized into 24 groups (See **Supplemental Digital Content 1**, Table E1, http://links.lww.com/WNO/A278). Diagnoses with less than 10 cases or trauma cases were placed in the "Others" category.

Six hundred eighty-three records contained information about pain characteristics. Four hundred ninety-eight described "burning pain," 70 records noted "stabbing pain," and 115 documented pain with eye movement.

The most common causes of eye pain in the UU Department of Ophthalmology and the USZ Department of Ophthalmology are summarized in Table 1. The most common causes of eye pain in the UU Department of Neurology and the USZ Department of Neurology are summarized in Table 2. The differences between the 2 institutions also were compared (See **Supplemental Digital Content 2**, Table E2, http://links.lww.com/WNO/A279).

If the data from the 2 ophthalmology clinics are combined, the most common causes of eye pain were conjunctivitis/keratitis/infection (38.2%), dry eye/blepharitis (19.1%), uveitis (6.2%), cataract surgery or other anterior segment disease (N = 85; 3.5%), and hordeolum/chalazion (3.5%) (Table 3). From the combined data of both neurology departments, the most common causes of

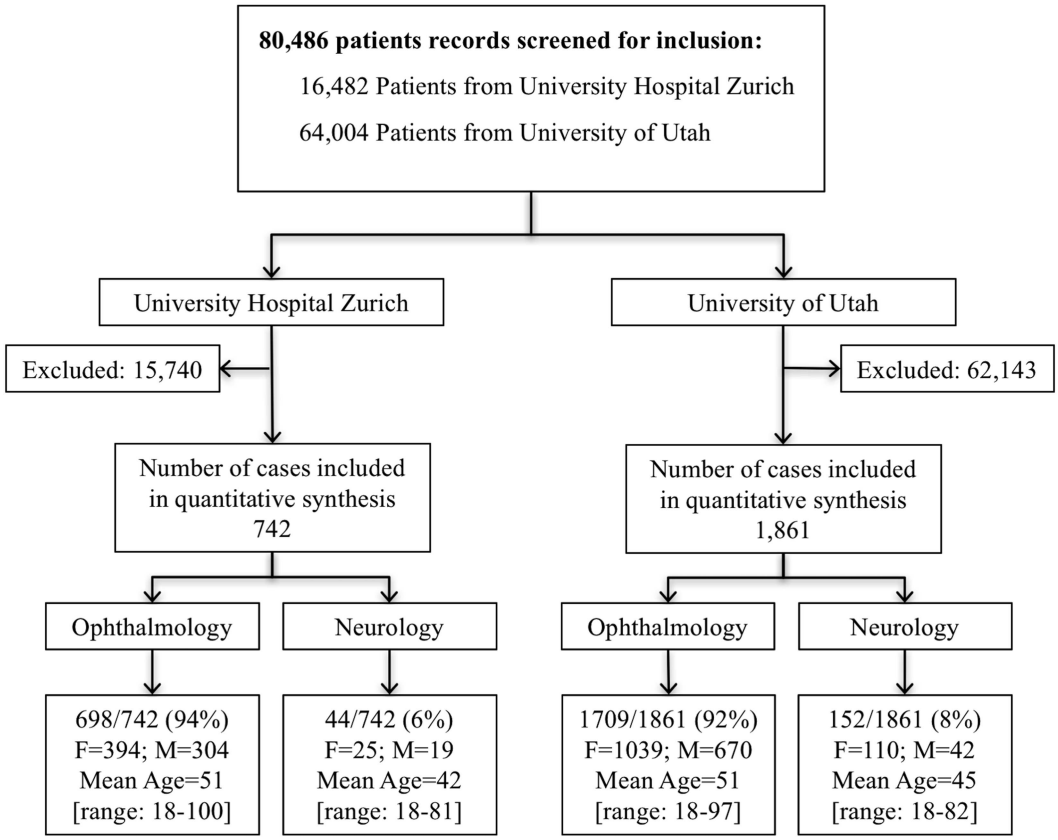

FIG. 1. Flow diagram of study selection process for the identification of patients with eye pain at the University Hospital Zurich, Switzerland and the University of Utah, USA in both the departments of neurology and ophthalmology.

eye pain were headache/migraine (N = 100; 51.0%), optic neuritis (N = 44; 22.5%), trigeminal neuralgia/other cranial nerve disorders (N = 8; 4.1%), dry eyes/blepharitis (N = 6; 3.1%), and ischemic/thrombotic events (N = 4; 2.0%) (Table 4).

Pain laterality also is summarized in Tables 3 and 4. Unilateral eye pain was more likely to be associated with a diagnoses of cellulitis ($P = 0.004$), ocular/periocular injury ($P = 0.045$), ischemic/thrombotic events ($P = 0.017$), keratopathy/corneal dystrophy ($P = 0.003$), foreign body ($P = 0.004$), scleritis ($P < 0.001$), herpes virus ($P < 0.001$), optic neuritis ($P = 0.002$), hordeolum/chalazion ($P < 0.001$), uveitis ($P < 0.001$), and conjunctivitis/keratitis/infection ($P = 0.003$). Patients with bilateral eye pain were more likely to be diagnosed with idiopathic intracranial hypertension (IIH; $P = 0.002$) and dry eye/blepharitis ($P < 0.001$).

Eye pain characteristics were assessed (Table 5). "Burning" eye pain was more likely to be associated with conjunctivitis/keratitis/infection (N = 246; 49.9%) and dry eye/blepharitis (N = 138; 27.7%). "Stabbing" eye pain was also more likely to be associated with conjunctivitis/keratitis/infection (N = 16; 22.9%), headache/migraine (N = 13; 18%), and dry eye/blepharitis (N = 9; 12.9%). Pain with eye movement was most likely to be associated with optic neuritis (N = 37; 32.2%), dry eye/blepharitis (N = 10; 8.7%), and headache/migraine (N = 10; 8.7%).

Women were more likely to complain of eye pain due to headache/migraine ($P = 0.004$), dry eye/blepharitis ($P < 0.001$), IIH ($P = 0.002$), and a recent history of cataract and other anterior segment surgery ($P = 0.049$). Men were more likely to report eye pain due to foreign body ($P < 0.001$) and keratopathy/corneal dystrophy ($P = 0.037$) (See **Supplemental Digital Content 3**, Table E3, http://links.lww.com/WNO/A280).

DISCUSSION

In the departments of ophthalmology, more than 60% of patients were found to have ocular inflammatory conditions as the cause of eye pain. In the departments of neurology, more than 50% of patients had a headache disorder such as migraine identified as the cause of eye pain.

Some pain characteristics were strongly associated with an underlying diagnosis. "Burning" was highly associated with keratitis, dry eye, and blepharitis, whereas stabbing pain was highly associated with headache/migraine. Patients diagnosed with conjunctivitis commonly reported both burning and stabbing pain. Optic neuritis was strongly associated pain with eye movement, but only 32% of

TABLE 1. Patient demographics and diagnoses in 2 departments of ophthalmology

	UU (N = 1,709)		USZ (N = 698)	
	Total (N)	% UU Ophth	Total (N)	% USZ Ophth
Age at admission, yr				
18–34	338	20	265	38
35–54	510	30	240	34
55–65	302	18	84	12
65+	559	33	109	16
Sex				
Female	1,039	61	394	57
Male	670	39	304	44
Unilateral	1,015	60	464	67
Diagnosis				
Conjunctivitis/keratitis/infection	552	32	368	53
Dry eye/blepharitis	348	20	111	16
Uveitis	102	6	48	7
Cataract or other anterior segment surgery	84	5	1	0
Headache/migraine	69	4	2	0
Ectropion/entropion/lid disorder	57	3	6	1
Herpes virus	49	3	9	1
Scleritis	35	2	21	3
Foreign body	34	2	0	0
Hordeolum/chalazion	33	2	51	7
Optic neuritis	26	2	1	0
Glaucoma	26	2	14	2
Keratopathy/corneal dystrophy	25	2	2	0
Retinal disease	21	1	10	1
Contact lens wear	20	1	0	0
Idiopathic intracranial hypertension	16	1	1	0
Ischemic/thrombotic events	11	1	3	0
Cranial mass/neoplasm	7	0	2	0
Cellulitis	5	0	8	1
Trigeminal neuralgia/other cranial nerve disorder	5	0	0	0
Orbital myositis	5	0	6	1
Others	64	4	11	1
Unknown	115	7	23	3

USZ, University Hospital Zurich; UU, University of Utah.

patients with this description of their pain were ultimately diagnosed with optic neuritis. Other causes of pain with eye movement were orbital myositis, headache/migraine, uveitis, and ocular surface disease (Table 5).

Implications of Findings

It should not be surprising that many neurologic conditions are associated with eye pain as the eye and orbit are innervated by the trigeminal nerve. The first division of the trigeminal nerve, the ophthalmic branch (V^1), transmits both direct *and* referred pain. Intracranial processes can elicit referred eye pain due to innervation by the ophthalmic nerve of the dura in the anterior fossa, tentorium, falx, and superior sagittal sinus. Because the eye and these intracranial structures are both innervated by the ophthalmic nerve, a number of intracranial disease processes, including vascular disease, tumors, increased intracranial pressure, infection, and inflammation, have the ability to manifest as eye pain. The sensory territory of the ophthalmic overlaps with the territory covered by the sensory root of C2. C1-2 stimulation can cause pain to the eye, forehead, vertex, and, rarely, the back of the head (1).

The most common causes of eye pain in the ophthalmology departments were associated with signs that would be detected with a complete ophthalmic examination. However, a number of important and treatable causes of eye pain were associated with a normal eye examination, such as migraine and other headache disorders. These were the most common causes of eye pain in the neurology clinics, but these disorders also may find their way into ophthalmology clinics as patients with eye pain are likely to seek help from an ophthalmologist.

We found that migraine/headache was most often associated with a "stabbing" pain characteristic without a specific predilection for unilateral or bilateral involvement.

TABLE 2. Patient demographics and diagnoses in 2 departments of neurology

	UU (N = 152)		USZ (N = 44)	
	Total (N)	% UU Neuro	Total (N)	% USZ Neuro
Age at admission, yr				
18–34	30	20	21	48
35–54	67	44	16	36
55–65	32	21	5	11
65+	23	15	2	5
Sex				
Female	110	72	25	57
Male	42	28	19	43
Unlilateral	86	57	36	82
Diagnosis				
Headache/migraine	96	63	4	9
Optic neuritis	19	13	25	57
Dry eye/blepharitis	6	4	0	0
Trigeminal neuralgia/other cranial nerve disorder	5	3	3	7
Conjunctivitis/keratitis/infection	3	2	0	0
Ischemic/thrombotic events	2	1	2	5
Cataract or other anterior segment surgery	1	1	0	0
Herpes virus	1	1	0	0
Glaucoma	1	1	0	0
Idiopathic intracranial hypertension	1	1	1	2
Orbital myositis	1	1	0	0
Uveitis	0	0	0	0
Hordeolum/chalazion	0	0	0	0
Ectropion/entropion/lid disorder	0	0	1	2
Scleritis	0	0	0	0
Foreign body	0	0	0	0
Retinal disease	0	0	0	0
Keratopathy/corneal dystrophy	0	0	0	0
Contact lens wear	0	0	0	0
Cellulitis	0	0	0	0
Cranial mass/neoplasm	0	0	1	2
Others	7	5	6	14
Unknown	9	6	1	2

USZ, University Hospital Zurich; UU, University of Utah.

Patients with migraine often have a positive family history and also may report photophobia, phonophobia, osmophobia, vertigo, nausea, and vomiting. There are red flags in the history that should alert the clinician to a more serious, life-threatening etiology, including a description of a sudden or "thunderclap headache" or "worst headache of my life." These patients may need urgent evaluation for subarachnoid hemorrhage (from either a sentinel bleed or an unruptured aneurysm), dissection of the cervical or vertebral artery, venous sinus thrombosis, reversible cerebral vasoconstriction syndrome, intracranial hypotension, or posterior reversible encephalopathy syndrome (2).

Vascular Causes of Eye Pain

Although rare, vascular causes of eye pain are associated with significant morbidity and mortality and, therefore, early and accurate diagnosis is critical. Four patients (2%) who presented to one of the neurology clinics with eye pain were ultimately diagnosed with a vascular disorder with 2 having unruptured aneurysms. Unruptured aneurysms occur in 1%–6% of the adult population and are more frequently found in women (3). Because fibers of the ophthalmic nerve follow the third nerve within the lateral wall of the cavernous sinus, ocular pain can occur when the third nerve is compressed by an intracranial aneurysm (4). Headache may be the presenting complaint in about one-third of patients who harbor an unruptured aneurysm (5,6). The clinical feature of subarachnoid hemorrhage—the "thunderclap" headache or the "sudden onset of the worst headache of my life"—occurs in about 43% of those with a subarachnoid hemorrhage as the sentinel headache (6).

Within our patient cohort, eye pain caused by internal carotid artery dissection was seen in 1 patient. Internal carotid artery dissection has been shown to occur in

TABLE 3. Sex of patients and laterality of eye pain from 2 departments of ophthalmology

	Total		Female		Male		Unilateral		Bilateral	
Diagnosis	N	%	N	%	N	%	N	%	N	%
Conjunctivitis/keratitis/infection	920	38.2	534	37.3	386	39.6	601	40.6	317	34.3
Dry eye/blepharitis	459	19.1	310	21.6	149	15.3	125	8.5	333	36.0
Uveitis	150	6.2	89	6.2	61	6.3	128	8.7	22	2.4
Cataract or other anterior segment surgery	85	3.5	43	3.0	42	4.3	55	3.7	30	3.3
Hordeolum/chalazion	84	3.5	42	2.9	42	4.3	83	5.6	1	0.1
Headache/migraine	71	3.0	48	3.4	23	2.4	40	2.7	31	3.4
Ectropion/entropion/lid disorder	63	2.6	32	2.2	31	3.2	45	3.0	17	1.8
Herpes virus	58	2.4	29	2.0	29	3.0	49	3.3	9	1.0
Scleritis	56	2.3	30	2.1	26	2.7	50	3.4	6	0.7
Glaucoma	40	1.7	23	1.6	17	1.8	25	1.7	15	1.6
Foreign body	34	1.4	9	0.6	25	2.6	29	2.0	5	0.5
Retinal disease	31	1.3	17	1.2	14	1.4	24	1.6	7	0.8
Optic neuritis	27	1.1	14	1.0	13	1.3	17	1.2	10	1.1
Keratopathy/corneal dystrophy	27	1.1	11	0.8	16	1.6	24	1.6	3	0.3
Contact lens wear	20	0.8	13	0.9	7	0.7	11	0.7	9	1.0
Idiopathic intracranial hypertension	17	0.7	16	1.1	1	0.1	5	0.3	12	1.3
Ischemic/thrombotic events	14	0.6	7	0.5	7	0.7	13	0.9	1	0.1
Cellulitis	13	0.5	5	0.4	8	0.8	13	0.9	0	0.0
Orbital myositis	11	0.5	9	0.6	2	0.2	9	0.6	2	0.2
Cranial mass/neoplasm	9	0.4	7	0.5	2	0.2	7	0.5	2	0.2
Trigeminal neuralgia/other cranial nerve disorders	5	0.2	4	0.3	1	0.1	3	0.2	2	0.2
Others	75	3.1	46	3.2	29	3.0	49	3.3	26	2.8
Unknown	138	5.7	95	6.6	43	4.4	74	5.0	64	6.9

approximately 1–2/100,000 in the general population, most commonly with the symptom of head or neck pain (80%) (7). Although rare, eye pain as an isolated symptom has been reported (8); however, a more common presentation would be a painful Horner syndrome (45%) (9). Trigeminal innervation of the carotid artery is the cause of the referred eye pain associated with dissection.

Although a potentially serious cause of eye pain, we found eye pain associated with giant cell arteritis (GCA) only in 1 patient. More frequently, 90% of patients with GCA develop a severe, boring, sometimes burning headache that most often occurs in the temporal region (10,11).

Intracranial Tumors

Five pituitary tumors and 1 meningioma were identified, all presenting with eye pain. The sphenoid ridge, pituitary area, and cavernous sinus are often the origin of tumors inducing eye pain and headache because the

TABLE 4. Sex of patents and laterality of eye pain diagnoses from 2 departments of neurology

	Total		Female		Male		Unilateral		Bilateral	
Diagnosis	N	%	N	%	N	%	N	%	N	%
Headache/migraine	100	51.0	73	54.1	27	44.3	56	45.9	44	59.5
Optic neuritis	44	22.5	26	19.3	18	29.5	39	32.0	5	6.8
Trigeminal neuralgia/other cranial nerve disorders	8	4.1	5	3.7	3	4.9	7	5.7	1	1.4
Dry eye/blepharitis	6	3.1	4	3.0	2	3.3	1	0.8	5	6.8
Ischemic/thrombotic events	4	2.0	3	2.2	1	1.6	3	2.5	1	1.4
Conjunctivitis/keratitis/infection	3	1.5	2	1.5	1	1.6	2	1.6	1	1.4
Idiopathic intracranial hypertension	2	1.0	2	1.5	0	0.0	0	0.0	2	2.7
Cataract or other anterior segment surgery	1	0.5	0	0.0	1	1.6	1	0.8	0	0.0
Ectropion/entropion/lid disorder	1	0.5	1	0.7	0	0.0	1	0.8	0	0.0
Herpes virus	1	0.5	1	0.7	0	0.0	1	0.8	0	0.0
Glaucoma	1	0.5	0	0.0	1	1.6	1	0.8	0	0.0
Orbital myositis	1	0.5	1	0.7	0	0.0	0	0.0	1	1.4
Cranial mass/neoplasm	1	0.5	0	0.0	1	1.6	1	0.8	0	0.0
Others	13	6.6	8	5.9	5	8.2	4	3.3	9	12.2
Unknown	10	5.1	9	6.7	1	1.6	5	4.1	5	6.8

TABLE 5. Characteristics of eye pain associated with etiology

	Burning (N = 498)		Stabbing (N = 70)		With Eye Movement (N = 115)	
	N	%	N	%	N	%
Age at admission, yr						
18–34	128	25.7	16	22.9	50	43.5
35–54	163	32.7	22	31.4	36	31.3
55–65	86	17.3	13	18.6	18	15.7
65+	121	24.3	19	27.1	11	9.6
Gender						
Female	301	60.4	50	71.4	72	62.6
Male	197	39.6	20	28.6	43	37.4
Enrolment site						
Utah	269	54.0	34	48.6	63	54.8
Zurich	229	46.0	36	51.4	52	45.2
Department						
Neurology	3	0.6	15	21.4	35	30.4
Ophthalmology	495	99.4	55	78.6	80	69.6
Unilateral						
No	273	54.9	21	30.0	20	17.4
Yes	224	45.1	49	70.0	95	82.6
Diagnosis						
Conjunctivitis/keratitis/infection	246	49.4	16	22.9	7	6.1
Dry eye/blepharitis	138	27.7	9	12.9	10	8.7
Herpes virus	12	2.4	0	0.0	1	0.9
Foreign body	12	2.4	0	0.0	1	0.9
Uveitis	11	2.2	4	5.7	7	6.1
Headache/migraine	8	1.6	13	18.6	10	8.7
Cataract or other anterior segment surgery	8	1.6	1	1.4	1	0.9
Hordeolum/chalazion	8	1.6	0	0.0	0	0.0
Ectropion/entropion/lid disorder	8	1.6	1	1.4	0	0.0
Keratopathy/corneal dystrophy	8	1.6	4	5.7	3	2.6
Scleritis	4	0.8	2	2.9	4	3.5
Glaucoma	3	0.6	3	4.3	1	0.9
Retinal disease	3	0.6	0	0.0	0	0.0
Contact lens wear	2	0.4	1	1.4	1	0.9
Idiopathic intracranial hypertension	2	0.4	2	2.9	1	0.9
Cellulitis	2	0.4	0	0.0	2	1.7
Cranial mass/neoplasm	2	0.4	0	0.0	1	0.9
Optic neuritis	1	0.2	1	1.4	37	32.2
Ischemic/thrombotic events	1	0.2	2	2.9	0	0.0
Trigeminal neuralgia/other cranial nerve disorders	0	0.0	2	2.9	1	0.9
Orbital myositis	0	0.0	0	0.0	5	4.4
Others	4	0.8	1	2.8	10	8.7
Unknown	15	3.0	7	10.0	12	10.4

trigeminal system richly innervates areas of the dura and blood vessels at the base of the brain. Third and sixth nerve palsies may also be seen with these tumor locations (12,13) and headache may be part of the symptom complex in about 60% of patients (14).

Intracranial Hypertension

IIH was the cause of eye pain in 16 patients within the neurology and ophthalmology departments. Our study showed that IIH is more likely to be associated with bilateral rather than unilateral eye pain. Headache is the most common presenting symptom in IIH and can have associated retrobulbar pain and pain with eye movement (15).

Glaucoma

Forty-one patients (1.7%) had eye pain due to glaucoma within the departments of ophthalmology. Only 1 patient with eye pain due to glaucoma was reported from the departments of neurology. In our cohort, there were no statistical associations with sex or unilateral/bilateral location, but burning and stabbing were noted to be more

common with this diagnosis. Persons with very high intraocular pressure (>40 mm Hg) or those with a rapid rise in intraocular pressure may present with eye pain, headache, vision changes, or nausea and vomiting. Headache pain may be more severe than eye pain and is characteristically ipsilateral forehead pain.

Orbital Myositis

Orbital myositis was present in 12 patients (0.5%) presenting to the ophthalmology clinics. Orbital myositis usually causes pain that worsens with eye movement and is generally most painful when moving in the direction of the inflamed muscle (16). No patients were diagnosed with trochleitis, which produces severe ocular and periocular ache (superomedial orbital rim), which also worsens with eye movement (17).

Study Limitations

The main limitations of our study are related to the retrospective nature of data collection and the different methodologies used to search the EMR at UU and at USZ. In addition, different providers may have tailored their documentation such that historical and physical characteristics were included or excluded to support a final diagnosis. We would not have identified charts in which eye pain was described by the patient but not documented by the physician.

Conclusions

Most patients evaluated in the ophthalmology clinics had eye pain due to ocular inflammatory conditions that were diagnosed on physical examination. For patients with normal findings, it is important to consider migraine, trigeminal neuralgia, other headache syndromes, and cervicogenic headache. These patients would benefit from a neurology referral. Most eye pain cases in neurology were migraine/headache and optic neuritis; for patients with vision loss or a red eye, one should consider referral to ophthalmology. For optimal care of many patients with eye pain, ophthalmology and neurology departments must consult, cooperate, and collaborate for accurate diagnoses and management. In primary care, referral to ophthalmology should be considered for a red eye or vision loss; consider migraine/headache in patients with a white eye and no vision loss and refer to neurology. It is vital that the uncommon but potentially sight- or life-threatening conditions are always considered, including carotid dissection, brain tumor, cerebral aneurysm, GCA, and acute glaucoma.

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